ART. XVI. SCOLECODONTS FROM THE WINDOM, MIDDLE DEVONIAN, OF WESTERN NEW YORK

By E. R. Eller

(Plates XXXVII-XXXVIII)

While pursuing his studies of the geology and paleontology of western New York, Dr. Irving G. Reimann of the Buffalo Museum of Science found a single specimen of a scolecodont or fossil polychaete jaw. He found the jaw on the surface of a piece of concretionary material from near the base of the Windom Member, Moscow Formation, Hamilton Group of the Devonian on White Creek near East Bethany, New York. He called my attention to this discovery and together we examined the locality thoroughly for additional jaws. No other specimens, however, were detected in the field or on the surface of the several hundred pounds of material collected. The impure limestone layer, in which the scolecodont was found, is of a concretionary structure with phosphatic nodules. It dissolves very slowly in weak acid, resulting in a residue of muddy, silicious material with some pyrite crystals. An occasional jaw was found in this residue. The thin distinctive layer was traced to Bowen Brook, two and one-half miles northwest of Alexander, to Murder Creek near Darien, and to several other localities. Farther east, on Little Beard Creek at Leicester, and on Fall Brook near Geneseo, and at many other outcrops of the Windom through and east of the Finger Lake district, it was not possible to find this particular layer. Several concretionary layers were found near the base of the Windom but none had the phosphatic nodules. However, a large amount of material was collected from each of the localities visited and jaws were recovered from White Creek, Bowen Brook, Murder Creek, Little Beard Creek, and Tichenor Gully on Canandaigua Lake. The jaws were secured by dissolving the matrix in a five percent solution of hydrochloric acid. More than thirty gallons of concentrated acid were diluted to dissolve the several hundred pounds of rock. This procedure was mostly accomplished in the laboratory by Mr. David Seaman and the writer is most appreciative of his help. The

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residue was carefully searched and about one complete or broken specimen was recovered in a day's work. In all, eighty-eight good specimens and perhaps an equal number of broken ones were found.

The specimens are distributed among fourteen new species, four known forms and two which are identifiable only generically. Several other questionable forms were neither figured nor described. The jaws, in general, are very small, measuring from .13 to .87 mm. in length. As in other scolecodont faunas, the writer (1934, 1938, 1940) has found one dominant species (in the present collection it is *Nereidavus harbisonæ* m.), which seems to be represented by twice as many as any other. The scolecodont fauna from the Windom of New York has four species that are found in both the Widder beds and the Olentangy shale of Ontario, and two in the Silica Shale of Ohio. Perhaps when more is known of these faunas, correlations of the beds may be made. One species is found also in the Potter Farm Formation of Michigan.

A large number of ostracod valves were found in the residue, especially in that from the Bowen Brook locality. Long, soft, fibrous structures with horizontal lines are common in some of the residue. These are found in single strands or in closely bound bundles. A single strand measures less than .05 mm. in diameter and is often transparent, with thickened margins. There are also suggestions of pores on some of the strands. Very interesting, soft, rubbery, black, hollow, spherical objects, less than .2 mm. in diameter, are common in much of the limestone. Often they are found as flattened discs. The writer will not attempt to determine their nature. Hinde (1879) mentioned that his Middle Devonian jaws of Canada were found associated with the spores of Lycopods. It is possible that they may be egg-cases. Acid does not affect them. On first examination it was thought that the objects were some sort of a fungus growth on the surface of the rocks, but since they are also found imbedded, it is probable that they are not of recent origin. Other microscopic forms recovered, which have passed through a twenty mesh sieve, are gastropods, bryozoans, two species of pteropods, and some sponge spicules.

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The holotypes of the species described in this paper are at the Carnegie Museum; the paratypes have been divided between the Academy of Natural Sciences of Philadelphia and Princeton University.

DESCRIPTION OF SPECIES

Genus NEREIDAVUS, Grinnell, 1877

Nereidavus harbisonæ sp. nov.

Maxilla I, plate XXXVII, figs. 1, 2, 4, 5.

The asymmetrical right and left jaws are long and narrow, and measure from .23 to .8 mm. in length, with the average about .5 mm. From ten to fifteen small, sharp, triangular-shaped denticles extend along about one-half the length of the inner margin. The denticles begin about one-third the distance from the anterior end and gradually increase in size posteriorly. A large fang is curved backward, oblique to the plane of the lower surface. The inner margin is nearly straight but incurves abruptly to the fang. The outer margin curves irregularly but is generally parallel to the inner margin. The left and right jaws differ fundamentally at the posterior end. The posterior end of the right jaw is irregularly truncate, while the left jaw is indented by a small, shallow bight. This difference in the posterior end of the left jaw radically changes the shape of the fossa from a wide, deep cavity at the anterior end to a narrow but fairly deep cavity at the posterior end. The fossa of the right jaw is wide and deep anteriorly but becomes slightly convex or flattened posteriorly. This shallowness is reflected on the lower surface of the right jaw. A wide, well rounded margin surrounds the fossa of both left and right jaws. The upper and lower surfaces of both left and right jaws are generally convex but have many irregular concave areas. One of the concave areas often begins close to the fang and continues along the outer margin giving it the appearance of a ridge.

Two species, *Nereidavus invisibilis* Eller (1940) and *Nereidavus perlongus* Eller (1934), similar to *Nereidavus harbisonæ*, were described by the writer from the Silurian at Niagara Gorge, New York, and from the Upper Devonian near Alfred Station, New York. In both these species the left and right jaws were described. In the present collection, and in the two mentioned above, the majority of the specimens are jaws of this type and there is about an equal number of right and left jaws in all three. *Œnonites aspersus* Hinde (1882) is similar to *Nereidavus harbisonæ*, in a general way but differs in the character and arrangement of the denticles and in the size of the fang. Zebera (1935) described two species, *Arabellites perneri* Zebera and *Arabellites kittneri* Zebera, which are probably related to *Nereidavus harbisonæ*, but since the posterior ends are missing, no comparison can definitely be made. The forms most closely related to *Nereidavus harbisonæ* were described by Stauffer from the Hamilton group of Ohio and Ontario. *Nereidavus ontarioensis* Stauffer (1939) is similar to the left jaw of *Nereidavus harbisonæ* and

Nereidavus planus Stauffer (1939) to the right jaw. There are, however, several principal differences between these forms. In *Nereidavus harbisonæ* the jaw is more narrow, the denticles are less in number and begin more posteriorly, the fang much longer, thinner and more hooked, and the bight on the posterior end of the left jaw is not so deep.

The specific name is given to this new species in honor of Miss Helen D. Harbison in appreciation of her interest in paleontological research.

Nereidavus hamulus sp. nov.

Maxilla I, plate XXXVII, fig. 3.

The jaw is long, widens centrally, and narrows to an acute posterior extremity. A typical jaw measures .6 mm. in length. Along the straight inner margin six denticles extend only to the mid-point of the jaw. The first two denticles begin close to the fang and are sharp, conical, and point in a forward direction. The remaining four are rounded, perpendicular to the margin, and decrease in size posteriorly. The fang is small and only slightly hooked. The outer margin curves gently from the fang to the posterior. A wide, deep, triangular-shaped fossa is limited to the posterior third of the jaw. The margin of the fossa is thickened and well rounded. The upper and lower surfaces of the jaw are convex but may be slightly concave at various places, especially on the lower side.

Jaws of this type have been described, by the writer and others, under the following genera: *Arabellites*, *Œnonites*, and *Nereidavus*. This is probably due to the very broad definitions of the various genera. For the present, this species will be placed under the genus *Nereidavus*. No other forms correspond very closely to this species. *Nereidavus antiquus* Hinde (1880) has an anterior end similar to *Nereidavus hamulus*. The posterior extremity, including the fossa, of the right jaw of *Nereidavus invisibilis* Eller (1940) resembles *Nereidavus hamulus*. The fang, the denticles and their arrangement suggest a similarity between *Nereidavus perlongus* Eller (1939) and *Nereidavus hamulus*. The outline of the jaw and fossa of *Œnonites peraculus* Eller (1940) and *Arabellites plenidens* Eller (1940) are somewhat like *Nereidavus hamulus*.

GENUS ŒNONITES, Hinde, 1879

Œnonites excavatus sp. nov.

Maxilla II, plate XXXVII, figs. 6, 7.

The jaw is small, wide anteriorly, and tapers to an acute posterior extremity. On the convex lower surface a series of nine, very sharp, thin,

conical, backward directed denticles extend the full length of the jaw. The first denticle is of medium size, the second very large, followed by one or two small ones. The remaining denticles are large and at the posterior end suddenly decrease in size. The inner margin is nearly straight, while the outer margin is straight or slightly curved from the anterior and then forms an abrupt angle about midway and becomes nearly straight to the posterior end. The upper surface is taken up completely by the fossa which is wide at the anterior but becomes very narrow posteriorly. The fossa is deep but becomes shallow along the outer margin. The thickened margin of the fossa is wide and well rounded. Each specimen measured .36 mm. in length.

This form does not resemble any other very closely. *Œnonites levis* (Eller, 1940) is, perhaps, the nearest species, but it has the suggestion of a shank on the outer margin and the fossa is not similar at all.

Œnonites tenuis sp. nov.

Maxilla II, plate XXXVII, fig. 8.

The jaw is narrowly elongate and measures .35 mm. in length. A series of seven, large, conical, slightly hooked, backward directed denticles extend along the straight inner margin to the acute posterior end. The fang is very thick, short, and not particularly hooked. The outer margin is straight and parallel to the inner margin. A long, narrow fossa extends nearly the full length of the jaw. The margin of the fossa is thickened and rounded. Both the upper and lower surfaces are convex.

Except for the number and size of the denticles, *Œnonites parvulus* Hinde (1882) resembles *Œnonites tenuis* in a general way. *Œnonites grandidentatus* Eller (1934) is similar to *Œnonites tenuis* in its length, narrowness, and the type of denticles, and fossa.

Œnonites cadwaladeri sp. nov.

Maxilla II, plate XXXVII, figs. 9, 10.

The jaw is elongate, narrow, and tapers to an acute posterior extremity. In length the jaw measures .6 mm. On the inner margin twelve, large, sharp, conical, backward directed denticles extend to the posterior end. The first denticle is large and is followed by two very small ones. The following denticles are large but decrease in size posteriorly. The outer margins are straight and parallel. On the upper surface a narrow, deep fossa extends the full length of the jaw. Its margins are thickened and rounded. The upper surface is slightly concave between the fossa and the denticles while the lower surface is convex.

The interesting feature of this beautiful and unique species is the large

size of the denticles in proportion to the narrowness of the jaw. There are no particularly close relationships with this form except, perhaps, *Œnonites grandidentatus* Eller (1934) and in this case only in a general way.

At the suggestion of Professor B. F. Howell, it gives me pleasure to name this species in honor of Dr. Charles M. B. Cadwalader, President of The Academy of Natural Sciences of Philadelphia, in appreciation of his encouragement and his support of this research.

Genus ILDRAITES, Eller, 1936

Ildraites bowenensis sp. nov.

Maxilla I, plate XXXVII, figs. 19, 20.

The jaw is wide anteriorly and tapers to a narrow posterior extremity. The length of an average specimen is .65 mm. On the gently curved inner margin a series of ten, rather large, conical, backward directed denticles extend nearly to the posterior end. There is very little or no space between the denticles. The first denticle, or fang, is short, heavy, and slightly oblique to the lower surface of the jaw. There is only a small space between the fang and the series of denticles. The outer margin incurves slightly to form a short, heavy shank. A wide, shallow bight emphasizes the width and shortness of the shank. The fossa is wide, not deep, of medium size, and extends from the end of the shank to the posterior extremity. The margin surrounding the fossa is heavy and its edges are well rounded. The upper surface of the jaw is convex, while the lower one is slightly concave or flattened.

Arabellites anglicus Hinde (1880) is somewhat like *Ildraites bowenensis* except that the denticles are of a different character and the shank is not similar. *Arabellites dauphinensis* Stauffer (1939) appears to resemble, in a general way, *Ildraites bowenensis* except that the denticles, position of the hook in relation to the surface of the jaw, and the shape and position of the shank do not correspond.

Ildraites howelli sp. nov.

Maxilla I, plate XXXVII, figs. 11, 12, 15, 16.

The jaw is small and narrowly sub-triangular in shape. Measurements of the length range between .25 and .58 mm., with an average of about .44 mm. The inner margin is gently curved from the short, heavy fang. Along the inner margin is a series of twelve to fourteen, small, conical, backward directed denticles which begin just adjacent to the fang and which extend to the posterior end. The first five or six denticles are very

small while the remaining seven or eight are larger. The outer margin incurves abruptly to a medium sized shank. A shallow, crescent-shaped bight on the outer margin emphasizes the width of the shank. Only two-thirds the length of the jaw is occupied by the rather small fossa. The outer margins of the fossa are thickened and well rounded. The upper and lower surfaces are mostly convex, but there are some small, slightly concave areas near the margins and denticles.

Hinde (1882) described a species, *Arabellites anglicus* Hinde, from the Silurian of Gotland, in which the size and number of denticles remarkably resemble *Ildraites howelli*. They differ mostly in the width of the jaw and in the position and size of the shank and fossa. *Arabellites priscus* Stauffer (1939) resembles *Ildraites howelli* in a general way, but Stauffer's species differs in that it has more denticles, a greater width of jaw, a larger fang set at a different angle, and a shank that is oblique to the surface of the jaw. *Arabellites howelli* is somewhat like *Arabellites bowenensis* m. but the number and character of the denticles, and the shape and position of the shank are not the same.

Ildraites anatinus (Stauffer)

Maxilla I, plate XXXVII, figs. 17, 18.

Arabellites anatinus Stauffer, 1939, Jour. of Paleon., vol. 13, no. 5, p. 501, pl. 58, figs. 40-42, 50.

The jaw is large, wide at the mid-area, and tapers to an acute posterior extremity. The largest specimen measured .87 mm. in length. On the nearly straight inner margin a series of conical, closely set, backward directed denticles extend to the end of the jaw. They are not large and do not decrease very much in size posteriorly. The series of denticles is set usually in a uniform row, but the angle of incline may change from horizontal through nearly a complete arc in relation to the lower surface of the jaw. The fang is large, distinctly hooked, and may be in an oblique position to the lower side of the jaw. The outer margin is broadly curved from the fang to about two-thirds the length of the jaw where it is notched by a shallow, angular bight. A short, wide fossa beginning opposite the denticles extends to the posterior extremity. The fossa is deep near the margins but quite shallow in the central area. The margin of the fossa is narrow and rounded, and on the inner margin it forms a distinct ridge. The upper and lower surfaces of the jaw are convex except at the posterior end of the lower side where they are concave.

In his description of this species, Stauffer (1939), remarked that "This type of jaw falls under Hinde's genus *Arabellites*, and the species here described is very similar to one of his from the Silurian of Gotland. If,

however, they are maxillae I, as they appear to be, they are so different from the more normal form of the genus that they should be separated from it." In 1936 the writer did separate forms of this type under a new genus, *Ildraites*, and therefore feels justified in placing this species under that genus. The specimens figured by Stauffer from the Hamilton of Ontario seem to be precisely like the New York forms except that the fang of the latter is longer and thinner.

Ildraites anomalus sp. nov.

Maxilla I, plate XXXVII, figs. 13, 14.

The jaw is long, angular, and wide at the central area but tapers to an acute posterior end. The inner and outer margins are irregular. In length the jaws measure from .5 to .6 mm. On the straight part of the inner margin is a series of five to seven, irregular, medium sized, backward directed denticles that extend to the posterior extremity. A large, slightly hooked fang is curved obliquely to the lower surface of the jaw. The outer margin curves irregularly to a small shank which is notched by a shallow, crescent-shaped bight. A wide fossa begins at about the midpoint of the jaw and extends into the narrow posterior end. The fossa is deep near the margins but shallow in the center due to the reflection of a concave area on the lower side. The wide, heavy margins of the fossa are well rounded. The upper and lower surfaces are irregularly convex with many concave areas.

Since this species resembles *Ildraites anatinus* (Stauffer 1939) in most respects, on first examination the writer considered these jaws to belong to that form but believed they had been distorted in some way, thus giving them their rather abnormal appearance. However, after examining several specimens it was decided that they are somewhat different in several respects. In *Ildraites anomalus* the jaw is uniformly smaller and narrower, the number of teeth is less, and the bight is crescent-shaped rather than angular as in *Ildraites anatinus* (Stauffer 1939). Hinde (1882) described a species, *Arabellites spicatus* Hinde, that resembles this form in a general way. *Arabellites marcellusensis* Eller (1934) from the Hamilton Group near Canandaigua, New York, resembles *Ildraites anomalus* except for the number of denticles, size of the shank, depth of the bight, and character of the margins. *Ildraites anatinus* (Stauffer 1939) is somewhat like *Ildraites anomalus* except for the difference in the width of the jaw (including the shank) and the character of the fang and margins. *Ildraites peramplus* Eller (1940) is similar only in a general way to *Ildraites anomalus*.

Genus LUMBRICONEREITES, Ehlers, 1868

Lumbriconereites clavatus sp. nov.

Maxilla II, plate XXXVIII, figs. 1, 2.

The jaw is sub-triangular in outline and tapers to an acute posterior extremity. In length the jaw measures .38 mm. A series of ten, conical, backward directed denticles is located on the lower surface and extends to the posterior end. The denticle line is curved anteriorly but becomes straight posteriorly. The inner margin is straight from the anterior to a shank, the acuteness of which is accentuated by a deep crescent-shaped bight. The outer margin is gently curved to a small, angular shank and straight to the posterior end. A narrow, deep fossa extends about three-quarters the length of the jaw. The margin of the fossa is thickened and rounded. The lower surface of the jaw is concave, except for the ridge on which the denticles are situated and the thickened margins. The upper surface is convex.

Some of the varieties of *Lumbriconereites falciformis* Hinde (1882) are similar to *Lumbriconereites clavatus* in some ways. The inner margin and the arrangement of the denticles may be considered as corresponding. The outer margins are not at all alike.

Genus EUNICITES, Ehlers, 1868

Eunicites seamani sp. nov.

Maxilla III or IV, plate XXXVIII, figs. 3-5.

The jaws are small, irregularly oblong and rounded in outline. Measurements of the length range from .13 to .26 mm. From five to six, conical or blunt, usually closely set denticles are present on the inner margin. The first, and often the last, denticle is much sharper than the others. A large, wide fossa takes up almost the complete upper surface, leaving only a small concave area near the denticles. The margins of the fossa are slightly thickened and rounded. The lower surface is irregularly convex with a curved ridge in the central area. In all specimens examined no two outer margins were the same.

These jaws have many individual differences but they resemble each other in most respects. They do not resemble any other form of *Eunicites* except in a general way.

Eunicites sp. indet.

Plate XXXVIII, fig. 6

Only one specimen of this form of jaw or forceps was found in this collection and, since it may not be complete, the writer hesitates to describe it at this time.

Eunicites turgidus sp. nov.

Maxilla II or III, plate XXXVIII, figs. 8, 9.

The jaw is triangular in outline, wide anteriorly, and tapers to a blunt posterior end. On the straight inner margin, a series of ten or eleven, small, blunt, conical denticles extend about three-quarters the length of the jaw. The first denticle may be either a straight continuation of the anterior margin or slightly hooked. In length, the jaws measure from .25 to .37 mm. The anterior margin is straight and wide, while the outer margins are curved. A deep, large, wide fossa extends from the anterior to the posterior end. The margin of the fossa is thickened and rounded, if present. The upper surface of the jaw is highly convex while the lower one is slightly concave or flattened.

Most of the outer margins of the specimens were found in a broken condition, but a few nearly complete ones made a description possible. Except for a general likeness, there is not enough similarity between these jaws and those of other species of the genus to make comparisons necessary.

Genus LEODICITES, Eller, 1940

Leodicites scitulus sp. nov.

Maxilla II, plate XXXVIII, figs. 14, 15

The shape of the jaw is triangular; the length is .35 mm. Along the slightly curved inner margin a series of six, sharply pointed, conical denticles extend nearly to the blunt posterior extremity. The denticles, with the exception of the first two, are uniform in size. A small, curved first denticle is followed by a large, straight second denticle. All but the first denticle usually point in a backward direction. Toward the posterior end the denticles may decrease slightly in size. The anterior margin is fully rounded from the first denticle to the pointed shank. A deep, crescent-shaped bight on the outer margin emphasizes the curvature and acuteness of the shank. The fossa is shallow and very wide. It extends from a point opposite and close to the second denticle and from nearly the end of the shank to the posterior extremity of the jaw. A margin with rounded edges, especially thick at the anterior and inner sides, surrounds the fossa. The lower surface is concave at the anterior end and flattened or slightly convex at the posterior end. The upper surface is highly convex at the anterior end but becomes less so posteriorly.

Leodicites scitulus does not resemble closely any other species. *Arabellites ferox* Hinde (1882) is similar in some respects, but the position and shape of the fossa are different and the curvature of the shank is dissimilar. Except for the shank, there is a resemblance between the lower

surface of the species, *Arabellites magnificus*, described by Stauffer (1939) from the Widder Beds of Ontario. Stauffer's figures show only the lower side so a complete study cannot be made. The fossa, and in some specimens the shank of *Leodicites variedentatus* Eller (1940), resembles *Leodicites scitulus*. They differ greatly, however, in the number and character of the denticles and in the length of the jaw.

Leodicites magnificus (Stauffer)

Maxilla II, plate XXXVIII, fig. 7.

Arabellites magnificus Stauffer, 1939. Jour. of Paleon., vol. 13, no. 5, p. 503, pl. 57, fig. 7, pl. 58, figs. 1, 14.

In outline the jaw is triangular; the anterior and outer margins are almost at right angles. Measurements of the length range between .28 and .37 mm. Along the straight inner margin a series of seven or eight, sharply pointed, conical denticles extend practically to the posterior extremity. The denticles usually point in a backward direction, and are of various sizes. The first denticle is usually quite small, the second large, thin, and hooked. These first two are followed by denticles of various sizes which decrease toward the posterior end. The anterior margin is nearly straight and terminates in a long narrow shank which is almost at right angles with the jaw. The outer margin is slightly incurved. The fossa is wide and deep and extends almost the full length of the jaw. A thin margin with rounded edges is present around the fossa. The upper surface is highly convex while the lower one is slightly concave.

The forms described by Stauffer (1939) from the Devonian of Ohio and Ontario seem to resemble the New York specimens in all respects. Stauffer figures, however, only the lower sides of the jaws, but from the descriptions it is probable that the upper side is the same.

Leodicites reimanni sp. nov.

Maxilla II, plate XXXVIII, figs. 10-13.

The jaw is triangular in shape and measures .32 to .56 mm. in length. A series of ten to thirteen conical to triangular, often blunt, denticles extend almost the full length of the slightly curved inner margin. The denticles are not uniform in size and do not point backward or always in the same direction. The first denticle or the first and second denticles are small and point forward. They are followed by a large, powerful denticle that usually curves backward. One or two smaller denticles follow the third one. The remaining denticles are large and decrease in size to the posterior end. The anterior margin is nearly straight from the first

denticle and then is slightly incurved to form a wide but pointed shank. A shallow, crescent-shaped bight on the outer margin emphasizes the width of the shank. The fossa is narrow and deep, and extends from about the end of the shank to the posterior extremity. A thickened margin with well rounded edges is present on all sides of the fossa. The upper surface is highly convex but irregular. The lower surface is concave along the inner margin and slightly convex at the outer margin.

There are a number of species described under the genera *Arabellites*, *Leodicites*, and *Eunicites*, that may be compared with this form. *Arabellites similis* Hinde (1879) is not as wide as *Leodicites reimanni*, but has a similar arrangement of the denticles. The anterior margin of *Eunicites cristatus* Hinde (1882) is quite different from that of *Leodicites reimanni*, but otherwise the two species have a general likeness. *Arabellites contritus* Stauffer (1933) resembles *Leodicites reimanni* in many respects, especially in the character and arrangement of the denticles. *Leodicites reimanni* is almost identical with *Leodicites variedentatus* Eller (1940) except for the width and length of the jaw. Only a general likeness is discernible between *Leodicites scitulus* m. and *Leodicites reimanni*.

Genus STAUROCEPHALITES, Hinde, 1879

Staurocephalites truncatus sp. nov.

Maxilla I or II, plate XXXVIII, fig. 18.

The jaw is elongate and measures from .68 to .85 mm. in length. On the convex lower surface a series of eighteen, small, sharp, conical, backward directed denticles extend nearly to the posterior end. The first denticle is slightly larger with a long straight upper edge. The next two or three denticles may be small. The remaining denticles are quite uniform in size but may decrease slightly at the posterior end. The anterior end is irregularly broad and obliquely truncate. The posterior extremity is rounded. Both inner and outer margins are thin and are broken. The lower surface is slightly concave on each side of the denticles and convex at the anterior and posterior ends. The fossa occupies the complete upper surface of the jaw and is deep in the center toward the denticles but shallow at the margins.

Hinde (1879) described a genus, *Staurocephalites*, based on "Jaws of more or less elongated, compressed, denticulate plates, resembling those of the existing genus *Staurocephalus*, Grube." Stauffer (1933) added that the "Anterior tooth is slightly larger, and is followed by a series of gradually diminishing teeth, all directed backwards." After reviewing the various species described under the genus, the writer feels that one of the most important characters is that region at the anterior part of the jaw

where the margin is obliquely truncate to the first denticle. The inner and outer margins of most of these species seem to be thin and are usually broken. The genotype, *Staurocephalites niagarensis* Hinde (1879), is similar to *Staurocephalites truncatus* in a general way. In 1880 Hinde described *Staurocephalites serrula*, based on three variable specimens, but later, (1882), he placed this species in the genus *Eunicites*. One of these specimens, Hinde (1880), plate XIV, fig. 20, possesses the characters of the genus *Staurocephalites* and has a slight resemblance to *Staurocephalites truncatus*. Stauffer (1933) described two species, *Staurocephalites acutidentatus* Stauffer and *Staurocephalites dentatus* Stauffer which resemble *Staurocephalites truncatus*, since the obliquely truncate anterior denticle arrangement and the uneven inner and outer margins are somewhat similar.

Genus ARABELLITES, Hinde, 1879

Arabellites hamiltonensis (Stauffer)

Maxilla I, plate XXXVIII, figs. 19, 20.

Protarabellites hamiltonensis Stauffer, 1939. Jour. of Paleon., vol. 13, no. 5, p. 509, pl. 57, figs. 22, 23; pl. 50, figs. 35, 36.

The jaw is irregularly oblong in shape. A series of seven to nine, conical, backward directed denticles is located on a narrow, elevated area nearly parallel to the inner margin. The space between the denticles and the inner margin is concave. The first denticle, which is small, is followed by larger ones which gradually decrease in size to the wide, obtuse, posterior extremity. The denticles incline toward the inner margin. The elongate fang, the tip of which often points toward the posterior, is oblique to the lower surface. The inner margin is nearly straight and has a heavy, rounded edge. The outer margin is nearly straight from the sharp hook of the fang to the posterior end. A large, wide fossa occupies nearly two-thirds of the area on the upper surface. It is deep along the inner margin and anterior part but rather shallow centrally and posteriorly. The upper and lower surfaces are convex with irregular concave areas. Typical specimens average .6 mm. in length, but one specimen measured 1.26 mm. and supported eleven denticles.

For the present, this species is being removed from the genus *Protarabellites* and placed in the genus *Arabellites*. In the writer's opinion, the form described above does not conform entirely with Stauffer's definition of the genus *Protarabellites*. The various species described by Stauffer (1933) under *Protarabellites* are not similar to *Arabellites hamiltonensis* (Stauffer) (1939) except for a flange on the inner margin. The

number and arrangement of the denticles, the anterior part, and the fang do not correspond at all. There are some slight differences between Stauffer's specimens from Ohio and Ontario and the New York forms. In the specimens described in this paper the positions of the fang and the denticles are not quite so oblique to the lower surface and the jaw is wider, especially at the posterior end. *Arabellites hamiltonensis* (Stauffer, 1939) is similar to *Arabellites spicatus* var. *contractus* Hinde (1880) from the Wenlock of England, later changed to *Arabellites contractus* Hinde (1882), in the description of the forms from the Silurian of Gotland. *Arabellites hamiltonensis* (Stauffer, 1939) has a straighter margin, a wider fossa, and a longer and thinner fang. If the flange on the inner margin of *Arabellites robustus* Stauffer (1939) is broken, then it somewhat resembles *Arabellites hamiltonensis* (Stauffer, 1939). Except for the greater width of the jaw and fossa, and the more hooked fang of *Arabellites hamiltonensis* (Stauffer, 1939), it resembles in many ways *Arabellites rectidens* Eller (1940).

Arabellites comis Eller

Maxilla I, plate XXXVIII, figs. 16, 17.

Arabellites comis Eller, 1938. Annals, Carnegie Museum, vol. 27, p. 227. pl. 28, fig. 9.

Arabellites comis Stauffer, 1940. Jour. of Paleon., vol. 13, no. 5, pp. 501-502, pl. 58, figs. 21, 22, 28.

The fang and the denticles of *Arabellites comis* Eller (1938) from the Potter Farm Formation of Michigan differ slightly from those of the forms figured in this paper and those described by Stauffer (1939) from Ontario. The New York forms measure .6 mm. in length and the inner margin bears from nine to eleven denticles, the posterior ones being very small.

Arabellites (?) sp. indet.

Maxilla I, plate XXXVIII, fig. 21.

This fragment of the anterior end of a jaw is that of the only large sized form found in the fauna. The very unusual wide thin keel situated on the fang makes this specimen extremely interesting. The writer heretofore has not met with a jaw having a structure of this kind. Placing the form under the genus *Arabellites*, is purely a guess and is a temporary arrangement. The fragment measures .65 mm. in length and if complete would probably be more than 4 mm. in length.

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EXPLANATION OF PLATE XXXVII

Figures magnified about 53 times.

Numbers in parentheses at the right indicate the Carnegie Museum catalogue numbers of the respective specimens.

FIGS. 1, 2. *Nereidavus harbisonæ* sp. nov.
Maxilla I, right jaw (22590).
Fig. 1. Under side.
Fig. 2. Upper side.

FIG. 3. *Nereidavus hamulus* sp. nov.
Maxilla I, right jaw, upper side (22642).

FIGS. 4, 5. *Nereidavus harbisonæ* sp. nov.
Maxilla I, left jaw (22589).
Fig. 4. Upper side.
Fig. 5. Under side.

FIGS. 6, 7. *Œnonites excavatus* sp. nov.
Maxilla II, left jaw (22612).
Fig. 6. Upper side.
Fig. 7. Under side.

FIG. 8. *Œnonites tenuis* sp. nov.
Maxilla II, right jaw, under side (22608).

FIGS. 9, 10. *Œnonites cadwaladeri* sp. nov.
Maxilla II, left jaw (22620).
Fig. 9. Under side.
Fig. 10. Upper side.

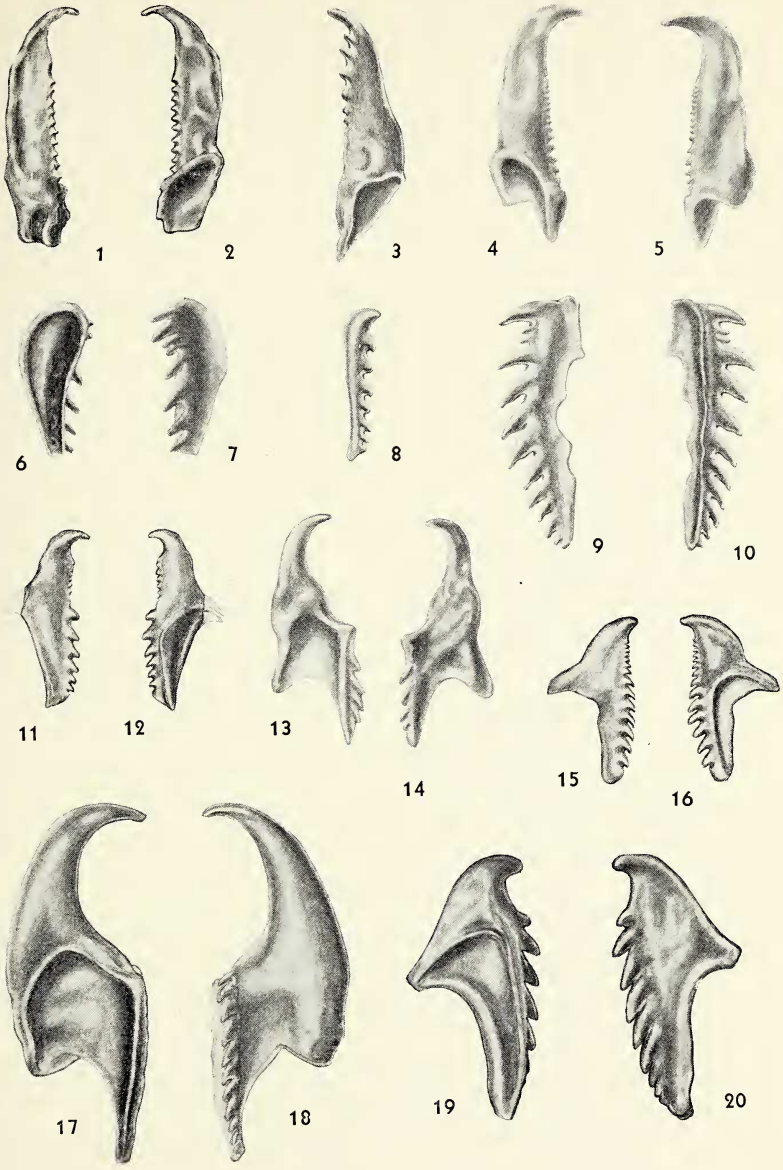
FIGS. 11, 12. *Ildraites howelli* sp. nov.
Maxilla I, right jaw (22646).
Fig. 11. Under side.
Fig. 12. Upper side.

FIGS. 13, 14. *Ildraites anomalus* sp. nov.
Maxilla I, left jaw (22629).
Fig. 13. Upper side.
Fig. 14. Under side.

FIGS. 15, 16. *Ildraites howelli* sp. nov.
Maxilla I, right jaw (22645).
Fig. 15. Under side.
Fig. 16. Upper side.

FIGS. 17, 18. *Ildraites anatinus* (Stauffer)
Maxilla I, left jaw (22616).
Fig. 17. Upper side.
Fig. 18. Under side.

FIGS. 19, 20. *Ildraites bowenensis* sp. nov.
Maxilla I, left jaw (22606).
Fig. 19. Upper side.
Fig. 20. Under side.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